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ARTICLE

Creating Next Generation Interactive Science Magazines with QR code

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ABSTRACT

Science magazines play a major role in the popularization of science among the public and creating scientific temper in the society. They act as a bridge between the scientific community and the society. Even though there are more than 50 science magazines published across the globe, very few have maintained consistency in publishing. *Scientific American* (started in 1845), *Popular Science* (1872), *MIT Technology Review* (1899) and *American Scientist* (1913) are very few that have been consistently published and have crossed the century mark.

But these magazines are read mainly by the academic elite, and not by students or lay men. Publishing science magazines is not an attractive business as it is hard to find advertisements and subscriptions. This has affected many regional and national science magazines brought out by publishing houses and individuals. In the long run magazines have life only if they can maintain readership.

In this era of digitization, science magazines should be made interactive with QR codes (Quick Response Code). Readers can scan the QR code using their smart phones and instantly view the contents of the magazine in a more interactive manner as videos or podcasts using web 4.0 technologies, which can be shared through social media platforms.

KEYWORDS: Science magazine, QR Code, Scientific temper, Science Popularization

Introduction

Progress in science and technology is so rapid that most scientists are only able to keep themselves updated in a highly specialized niche area of knowledge. All scientists, in other

words, are part of the general public when something that lies outside their field is discussed. There have always been scientists dedicated to disseminating their own work, the first being Galileo, who the Church never forgave for his choice to write in vulgate rather than in the more obscure Latin.

Over the years, however, their willingness to do so has changed. The Nineteenth century was one of the most propitious, especially in England. Beginning in 1826, and for over twenty years, Michael Faraday described the latest developments in science every Friday evening, during extremely crowded lectures held at the Royal Institution. Yet, in the first few decades of the Twentieth century scientists' enthusiasm for popularising science was already greatly declining. In 1938, Lancelot Hogben, afraid of jeopardizing his upcoming nomination as a Fellow of the Royal Society, asked his colleague, Hyman Levy to pretend to be the author of his book *Mathematics for the Million*, a popular work that became an international bestseller. Only in the 1980s was there a large scale resurgence of public engagement with the world of research.

Popular science magazines play a major role in the popularization of science among the public and creating scientific temper in the society. The scholarly scientific information published in peer-reviewed journals is not generally read by the general public and even researchers if the research happens to be outside their domain.

Scholarly articles published in journals are the result of years of hard work a researcher puts in. The work gets recognition only when the society understands the relevance of the work. In many cases the general public including the educated elite do not understand the utility of scientific research in their lives. Researchers rarely communicate to the public or even researchers from outside their domain of research. This causes a disconnect between the scientific communities and the society.

Popular science magazines act as a bridge between the scientific community and the society. Even though we have a systematic way of assessing the quality of science journals through JCR impact factor, as of now we have not developed any ranking to assess the popularity of quality of science magazines.

Science magazines hold an important position in science communication as they reach the general public.

The peer reviewed high impact factor journals are meant only for the researchers sitting in labs or for the shelves of libraries. Until and unless the matter published in these journals reaches the public, science doesn't get any acceptance. People may not understand why we are spending crores of rupees in scientific research. The complex articles published in journals cannot be understood either by educated persons in science nor persons working in the other fields of science. It's here science magazines act as an interlocutor for propagating the discovery. Articles published in science magazines like *Scientific American*, *New Scientist* or *BBC Science Focus* can be understood by any literate person working in every field of science.

Even though we have over 50 English popular science magazines published across the globe very few have maintained consistency in publishing. There are very few magazines that have survived the perils of the publishing sector and have been serving the scientific community over a period of hundred years (Table 1).

Table 1: Popular Science Magazines over hundred years old

Name of Magazine	Year of first print
<i>Scientific American</i>	1845
<i>Popular Science</i>	1872
<i>MIT Technology Review</i>	1899
<i>American Scientist</i>	1913

In India, the longest surviving science magazine is *Science Reporter* published by CSIR-NISCAIR which was started in the year 1964. Many reputed science magazines published by publishing houses have been closed down due to economic loss due to lack of subscriptions. The future of science magazines is bleak if we do not incorporate innovative techniques in the magazines to make them more reader friendly. One way of creating innovation in science magazines is to use the possibility of digital technology.

It is possible to say that wider use of the Internet and the decrease in the prices of mobile devices has increased the use of these devices. People can work without any restriction of place and make use of these devices for different purposes. According to Al-Khalifa (2011), one of the most important aspects of mobile phones is their ability to access the Internet anywhere, which makes it possible to reach the information at any time they need.

Mobile, namely ubiquitous learning is reshaping the learning environment. According to ABI Research (2013), there were 1.4 billion smart phones in the world. A report about the use of smart phones, which was published in 2014, shows that the number had reached 1.75 billion (*eMarketer*, 2014). Another study revealed that 89% of the smart phones are used all day (Smartphone users around the World, 2012).

QR CODES — A New Tool in ScienceCommunication

In 2012, the use of QR codes rocketed with its unique way of bridging the virtual and real world elements in journalism but it was not the only technology to do so. Since its birth several engagement technologies have been created; however, QR codes continually act as the front-runners in this increasingly interactive media.

The use of QR codes or 'Quick Response Codes' has become an increasingly popular element of the magazine industry in recent years. The 'code' is the familiar square grid often seen on posters or in magazines and can be read by most smart-phone mobile devices. The two-dimensional code was originally trademarked for the automotive industry, tracking vehicles during manufacturing in Japan, before becoming a feature in the magazine industry the world over.



The QR code

Quick-response (QR) codes are simple square-shaped pixelated barcodes that contain data. They allow the user to easily access websites, videos, text, maps, pictures, or contact information with a quick scan using their camera-equipped mobile devices and a free QR code reader app. There are many free resources for generating and reading QR codes for almost every smartphone or tablet with a camera, making them an easy and inexpensive way for learners to access media on a mobile device

Two types of QR codes are available – static and dynamic. Static QR codes contain data that cannot change once the QR code is printed. Dynamic QR codes include a short URL that is contained in the QR code itself, allowing users to change where the short URL redirects to even if the QR code has already been printed.

The limited amount of time and space allotted to present research findings often constrains the ability of scientists to communicate the potential implications of their work. Now more than ever, we seek creative and effective ways of interacting with diverse audiences about scientific topics. QR codes offer an opportunity to expand on the research and connect with people in a variety of ways.

Content linked to a QR code, for example, may be used to describe an in-depth sampling protocol for data collection including photos or how-to videos. A QR code may be added to a conference poster or presentation final slide to provide the audience an opportunity to follow-up and learn more, linking users to the author's research website or supplemental information.

How to Use QR Codes in Science Magazines

Once you have thoughtfully constructed the content, chosen your preferred QR code format, and selected a corresponding URL, you're ready to create a code and get your message out. Making a QR code is easily accomplished by the following steps:

1. Choose a QR code generator. A quick Google search will produce many options for QR code generators, including goQR.me, TAGO, QR Stuff, and QRCode-Monkey.
2. Copy the URL (or other alphanumeric data) that you want the code to link to into the appropriate section of the QR code generator.

3. Decide if you want to customize the color or shape of the QR code. QR codes typically appear black on a white background, but other colors can be used as long as the contrast is high between code and background.
4. Save the QR image as a vector file (e.g. a PDF), download the image to your computer, and place it onto your desired medium. You may want to give some direction along with the QR code so people know why it is there and what to do with it. While QR codes have been used successfully in advertising and marketing, their appearance in other contexts may be less familiar and benefit from clear instruction.

Most generators offer both free and paid services. *Free QR Code Tracker* offers a quick video on how to create a QR code, and the YouTube video *How to Create QR Codes* by Derral Eves goes into a little more detail.

How to Scan A QR Code

Just as there are numerous QR code generator websites, there are also many free QR code reader apps available for easy download. A few examples include ScanLife, QR Code Reader and Scanner, and QR Barcode Scanner.

Once the app is downloaded on your mobile device, simply open the app and point your device's camera at the QR code to scan it. Most QR code reader apps will make an audible noise when the code has been successfully recognized and take you directly to the corresponding media.

General Shortcomings

Accessing QR code-linked information requires the user to have a working mobile device equipped with a camera and a QR code scanner app (or the ability to download one). Users may not always have their mobile devices where QR codes are provided. In other words, just because you own a cell phone doesn't mean you always carry it with you to a conference presentation or on a hike in a park or wildlife refuge.

It may also be beneficial for scientific authors to include QR codes in their peer-reviewed articles to provide access to datasets

or software code. A potential limitation to this idea is that the reader may only access this supplementary information on their mobile device. An extra step is then required to transfer the information onto a computer and view it more comprehensively. Many websites are not currently mobile friendly, which exacerbates the need to transfer QR code content to a computer. Furthermore, linking a QR code to content that was not thoughtfully developed to communicate the intended message detracts from the usefulness of the technology, or worse, confuses the user's understanding of the topic.

Conclusion

The use of QR coding also offers scope for more interactive technologies within science magazine publishing. The biggest 'factor' in the use of QR codes is the large amount of choice given to the reader. The QR code effectively acts as a link between both the content in the article and its author. People can choose to access further information about a topic.

The technology has clearly demonstrated its potential for boosting interactivity, especially within the magazine industry. In an attempt to avoid over-use or complacency with the digitisation method, the use of QR codes seems to be headed in a more utilitarian direction. This will also be more tailored to a specific person's needs, perhaps in a more loyalty focused context. It could be considered that this reduces the original context of their creation, as they were created to encourage interactivity and build sales with customers; making it specific to only a loyal readership could significantly reduce its effectiveness.

Use of the codes has shown increased interactivity with readers; as recognition of the symbol increases so does its usage, according to *Nellymoser*, a mobile marketing firm. Almost 4,500 codes featured in the top 100 American magazine titles.

The noticeable enhancement QR coding offers the science magazine industry is its ability to directly engage with its readership. Written articles in print can, via the QR code, engage readers with a more connected media form. Some companies have added videos, connected people with social media and offered subscriptions. This form of interactive science journalism

not only forms a bridge between print and online publication but also slowly brings print and feature writing into a more broadcasted format.

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